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Optimized Deep Learning Schemes for Secured Resource Allocation and Task Scheduling in Cloud Computing - A Survey

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Abstract—Scheduling involves allocating shared resources gradually so that tasks can be completed within a predetermined time frame. In Task Scheduling (TS) and Resource Allocation (RA), the phrase is used independently for tasks and resources. Scheduling is widely used for Cloud Computing (CC), computer science, and operational management. Effective scheduling ensures that systems operate efficiently, decisions are made effectively, resources are used efficiently, costs are kept to a minimum, and productivity is increased. High energy consumption, lower CPU utilization, time consumption, and low robustness are the most frequent problems in TS and RA in CC. In this survey, RA and TS based on deep learning (DL) and machine learning (ML) were discussed. Additionally, look into the methods employed by DL-based RA and TS-based CC. Additionally, the benefits, drawbacks, advantages, disadvantages, and merits are explored. The work's primary contribution is an analysis and assessment of DL-based RA and TS methodologies that pinpoint problems with cloud computing.

Keywords— Task Scheduling, Resource Allocation, Mobile Edge Computing, Cloud Computing, Deep Learning, Fog Computing.

1. INTRODUCTION

Generally, software, storage, memory, and other computing resources are all available through the distributed computing system known as cloud computing [1]. Through the internet, it offers pay-per-use on-demand services [2]. The cloud services environments of network virtualization technologies are built and run using cloud computing [3, 4]. The cloud computing paradigm primarily focuses on how quickly and easily IT resources may be assigned, relieving end users of IT architecture and location issues [5]. Internet service providers are also referred to as Cloud consumers. The cloud service provider is in charge of handling and keeping cloud storage data, securing it, updating the software, lowering the cost of utilizing it, and enhancing the user experience [6].

To increase the utilization rate, cut down on makespan, and optimize the cloud services to prevent overloaded activities [7, 8]. Cloud computing manages the complexity of job scheduling in the virtual machine layer because of commercialization and virtualization [15]. Thus, scheduling is crucial in cloud computing to effectively and efficiently allocate resources to each activity [20]. The main issues with task scheduling include load balancing, scalability, dependability, performance, and developmental effects of resources on the computer nodes.

We must have a thorough understanding of the numerous issues related to various scheduling approaches as well as the challenges to be solved to design efficient scheduling algorithms. The goal of this study is to give a thorough assessment of task

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scheduling techniques and the related metrics that are appropriate for cloud computing settings. To determine which qualities should be taken into account in a particular system and which ones should be disregarded, we have researched several distinctive scheduling processes as part of this work. Various viewpoints are used to organize the literature review.

II. LITERATURE REVIEW

The integration of the security framework into a Decentralized has aided in ensuring the development of the data. Aida et al [21] suggested the primary concern first executing a scheduling framework is a novel, effective method for servicing numerous customers with various jobs safely and effectively.

A. Fog computing based TS & RA

Adam A et al [5] suggest a safe computation offloading method for a fog-cloud IoT environment. We achieve effective, secure offloading in a fog-IoT environment using Machine Learning (ML) techniques. In the beginning, Lakhan, et al [26]

suggest a brand-new network of heterogeneous computing nodes and components called the Vehicular. The summary of TS and RA in fog computing is detailed in table.1.

Table.1 Summary of RA and TS in fog computing

Author	Year	Technique	Advantage	Disadvantage
Baniata, et al [14]	2021	PF-BTS scheduling model	Better cost, low energy consumption, and high overhead	More complex, higher execution time, and decrease data rate
Jiang, et al [18]	2020	Secure computing RA model	Better performance, and higher resource utilization	Fog computing is the major issue, and energy latency trade-off problem
Sujana, et al [22]	2019	Trust technique-based scheduling of stochastic workflows	Minimize system cost, reduce service delay and high makespan	High complexity, high delay, and higher computational time
Cao, et al [25]	2021	IoV design based on fog computing	High throughput and load balancing	Not suitable for three-layer networks, and low response time
Guevara, et al [28]	2021	TS in fog computing systems	High throughput, and greater scalability	Minimizes CPU utilization and low throughput

B. Cloud computing and Multi-CC based TS & RA

Rani, et al [1] proposed efficient TS, that also permits even load sharing among nodes, it is possible to efficiently utilize these VM instances, improving response times. Dubey, et al [2] suggest a novel management scheme to support several enterprises of community cloud for safe cloud surroundings. Basu, et al [3] developed a significant field of research in CC TS, where effective algorithms are developed to allow service providers to assign work to a specific VM, improving both the performance and execution time of the activities. Ibrahim, et al [11] proposed cutting-edge TS heuristics are empirically compared to give readers a better understanding of how they perform. Muhammad, et al [13] examines and compares some of the most popular current scheduling methodologies. Tariq, et al [19] main goal is to examine how fuzzy logic is used in the most challenging CC research fields. To obtain the best schedule with the smallest makespan and cost, Sujana, et al [23] secured a scheduling method based on Smart PSO. Guo, et al [24] examines the topic of task distribution in an IoT edge-CC system that is both energy-efficient and delay-guaranteed. Mohiuddin, et al [27] developed a viable energy-saving strategy is the aggregation of VMs to reduce the overall number of active servers, but this requires effective resource management techniques. Sanaj, et al [29] propose a Chaotic Squirrel Search Algorithm (CSSA) in this research to schedule many tasks in a Platform as a Service (IaaS) cloud environment.

Qing-Hua, et al [12] developed a novel scheduling technology known as matching and Multi-Round Allocation (MMA) to maximize the number of iterations and overall cost for all allowing the project subject to security and reliability requirements in order to overcome trust restrictions in a heterogeneous multi-cloud environment. Bezdan, et al [16] offer the hybridized bat algorithm, a multi-objective work scheduling method based on swarm intelligence. Senthil Kumar, et al [32] proposes an efficient

multi-objective Hybrid GA-ACO (HGA-ACO) based work allocation method to handle the enormous cloud users' requests. The summary of multi-cloud based TS and RA is detailed in table.2.

Table.2 Summary of multi cloud computing in RA and TS

References	Writer	Method	Merit	Demerit
30	Shukri, et al	Improved multi-verse optimizer for TS in CC environments	Degree of imbalance and high response time	High cost, convergence speed and load balancing
37	Konjaang, et al	MOWOS	Minimize system cost, and reduce service delay	High complexity, delay, and computational time
44	Abdullah, et al	Integrated MOPSO system for TS in CC	Achieve stable results high throughput, and load balancing	Not suitable for three layer networks, low response time, and completion time
46	Albert, et al	Efficient KFCM and AFSO based RA in CC	More robust and fault-tolerant	Decreases execution time and extreme delays
53	Xingjuan, et al	Multi-objective intelligent algorithm for efficient TS in IoT	Reduce service delay, and minimize execution time	High complexity, delay, and computational time

C. Mobile edge computing based TS & RA

Zhang, et al [9] introduce a novel security layer in this study along with a combined load balancing and Computation Offloading (CO) method for MEC systems. Bhalaji, et al [17] proposed MEC combined with the data is released process taking into account the power utilization and the reaction time to manage the massive data flow and have secure data utilization in the IoT. Paymard, et al [30] designed an effective algorithm to reduce the overall execution time of users in a single-cell, PD-NOMA-based MEC system with numerous users and a single MEC server. Saleem, et al [51] suggest device-to-device (D2D) collaboration-based mobile end-user task offloading (MEC) to speed up the task performance of mobile users. The details summary of MEC based TS and RA is detailed in table.3.

Table.3 Summary of MEC for RA and TS

Year	Author	Technique	Benefits	Limitation
2020	Elgendy, et al [10]	Efficient and Secure Multi-task computation in MEC	High energy consumption, faster response, and improved resource utilization	Reduce resource usage, low makespan, and high complexity
2018	Ibrahim A, et al [19]	Efficient and secured framework for MEC	Minimize delay, and faster response	Increased energy consumption, high complexity, and low turnaround time
2018	Kim, et al [31]	SAMS for trusting particular resource information on MEC	Better efficiency in cloud computing and reduce overall turnaround time	Not consider dynamic behavior, low system loads and high complexity
2021	Weidang, et al [33]	RA with optimization for secure communications in MEC	High accuracy, load balancing, and memory	Lower bandwidth, delay and energy consumption
2020	Saleem, et al [34]	Mobility-aware joint TS and RS for cooperative MEC	Improved working efficiency, and CPU utilization	High complexity, delay, and computational time

III. CONCLUSION

The methods utilized in DL for TS and RA in CC are studied and addressed in this study, which also looks into DL and ML-based CC models. Additionally, consider the benefits and drawbacks of the most current articles using the TS, RA, and DL approaches. The dataset utilized for the dominant techniques is also provided while addressing the benefits and drawbacks of these strategies. As a result, the issue has arisen in the mentioned existing approaches and examined used datasets. When comparing the two methods, DL-based approaches produce superior outcomes. However, high cost, lengthy, low robustness, mistake rate, and communication overhead problems are the key problems for TS and RA.

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